

WHAT IS CLAIMED IS:

1. A disc drive assembly comprising:

a head disc assembly comprising a disc having a surface and a track for storage of information, a head for writing and reading information to and from the disc, and an actuator arm for moving the head relative to the surface of the disc;

a housing comprising a base and a cover cooperating with one another to form a chamber therebetween in which at least a portion of the head disc assembly is housed; and

a damper structure operatively associated with the housing for dampening noise and/or vibration emanated from the head disc assembly, the damper structure comprising

a viscoelastic damper layer; and

a continuous, polymeric constraining layer intimately contacting and encasing the viscoelastic damper layer, the constraining layer having a greater stiffness and higher modulus of dynamic shearing elasticity than the viscoelastic damper layer, the constraining layer being molded from a high density filler and a moldable compound that is immiscible with the viscoelastic damper layer to provide a discrete interface between the constraining layer and the viscoelastic damper layer.

2. A disc drive assembly according to claim 1, wherein the viscoelastic damper layer comprises a polymeric reaction product of a

composition comprising a member selected from the group consisting of (meth)acrylic acid and (meth)acrylate.

3. A disc drive assembly according to claim 1, wherein the viscoelastic damper layer comprises a polyacrylate.

4. A disc drive assembly according to claim 1, wherein the viscoelastic damper layer comprises a member selected from the group consisting of nitrile rubbers and fluoroelastomers.

5. A disc drive assembly according to claim 1, wherein the viscoelastic damper layer is free of fillers.

6. A disc drive assembly according to claim 1, wherein the viscoelastic damper layer comprises a plurality of fragments that are noncontinuous with each other to provide interstices between the noncontinuous fragments.

7. A disc drive assembly according to claim 1, wherein the viscoelastic damper layer is continuous and non-fragmented.

8. A disc drive assembly according to claim 1, wherein the continuous constraining layer further comprises high density filler comprising a member selected from the group consisting of glass, carbon, aramids, metal, plastics, alumina, silica, silicon, ceramic, and graphite.

9. A disc drive assembly according to claim 1, wherein the constraining layer further comprises chopped fiberglass.

10. A disc drive assembly according to claim 1, wherein the modulus of dynamic shearing elasticity of the constraining layer is at least two orders of magnitude greater than that of the viscoelastic damper layer.

11. A disc drive assembly according to claim 1, wherein the modulus of dynamic shearing elasticity of the constraining layer is at least three orders of magnitude greater than that of the viscoelastic damper layer.

12. A disc drive assembly according to claim 1, wherein the modulus of dynamic shearing elasticity of the constraining layer is at least about 500,000 psi.

13. A disc drive assembly according to claim 1, wherein the modulus of dynamic shearing elasticity of the constraining layer is at least about 1,000,000 psi.

14. A disc drive assembly according to claim 1, wherein the constraining layer comprises a member selected from the group consisting of epoxy, polyurethane, polyester, acetal, polystyrene, acrylonitrile-butadiene-styrene, and polyvinylchloride.

15. A disc drive assembly according to claim 1, wherein the constraining layer comprises a polyester.

16. A disc drive assembly according to claim 1, wherein the damper structure is in intimate contact with an outer surface of the housing.

17. A disc drive assembly according to claim 1, wherein the damper structure is in intimate contact with an inner surface of the housing.

18. A disc drive assembly comprising:

a head disc assembly comprising a disc having a surface and a track for storage of information, a head for writing and reading information to and from the disc, and an actuator arm for moving the head relative to the surface of the disc;

a housing comprising a base and a cover cooperating with one another to form a chamber therebetween in which at least a portion of the head disc assembly is housed; and

a damper structure operatively associated with the housing for dampening noise and/or vibration emanated from the head disc assembly, the damper structure comprising

a viscoelastic damper layer; and

a continuous, polymeric constraining layer intimately contacting the viscoelastic damper layer and molded from a high density filler and a melt-flowable polymer matrix that is immiscible with the viscoelastic damper layer to provide a discrete interface between the constraining layer and the viscoelastic damper layer, the constraining layer having a greater stiffness than the viscoelastic damper layer, a modulus of dynamic shearing elasticity of at least 500,000 psi and higher than the viscoelastic damper layer, and a density of at least 3.0 grams per cubic centimeter.

19. A disc drive assembly according to claim 18, wherein the viscoelastic damper layer comprises a polymeric reaction product of a

composition comprising a member selected from the group consisting of (meth)acrylic acid and (meth)acrylate.

20. A disc drive assembly according to claim 18, wherein the viscoelastic damper layer comprises a polyacrylate.

21. A disc drive assembly according to claim 18, wherein the viscoelastic damper layer comprises a member selected from the group consisting of nitrile rubbers and fluoroelastomers.

22. A disc drive assembly according to claim 18, wherein the viscoelastic damper layer is free of fillers.

23. A disc drive assembly according to claim 18, wherein the viscoelastic damper layer comprises a plurality of fragments that are noncontinuous with each other to provide interstices between the noncontinuous fragments.

24. A disc drive assembly according to claim 18, wherein the constraining layer further comprises high density filler comprising a member selected from the group consisting of glass, carbon, aramids, metal, plastics, alumina, silica, silicon, ceramic, and graphite.

25. A disc drive assembly according to claim 18, wherein the constraining layer further comprises chopped fiberglass.

26. A disc drive assembly according to claim 18, wherein the modulus of dynamic shearing elasticity of the constraining layer is at least two orders of magnitude greater than that of the viscoelastic damper layer.

27. A disc drive assembly according to claim 18, wherein the modulus of dynamic shearing elasticity of the constraining layer is at least three orders of magnitude greater than that of the viscoelastic damper layer.

28. A disc drive assembly according to claim 18, wherein the constraining layer comprises a member selected from the group consisting of epoxy, polyurethane, polyester, acetal, polystyrene, acrylonitrile-butadiene-styrene, and polyvinylchloride.

29. A disc drive assembly according to claim 18, wherein the constraining layer comprises a polyester.

30. A disc drive assembly according to claim 18, wherein the density of the constraining layer is at least 5.0 grams per cubic centimeter.

31. A disc drive assembly according to claim 18, wherein the damper structure is in intimate contact with an outer surface of the housing.

32. A disc drive assembly according to claim 18, wherein the damper structure is in intimate contact with an inner surface of the housing.

33. A method for damping a disc drive assembly, comprising:  
providing a disc drive assembly comprising a head disc assembly and a housing, the head disc assembly comprising a disc having a surface and a track for storage of information, a head for writing and reading information to and from the disc, and an actuator arm for moving the head relative to the surface of the disc, the housing comprising a base and a cover cooperating

with one another to form a chamber therebetween in which at least a portion of the head disc assembly is housed;

heat molding a curable compound in a mold cavity of a mold in the presence of a viscoelastic damper layer that is substantially immiscible with the curable compound, and curing the curable compound into a continuous, polymeric constraining layer of a damper structure, the damper structure comprising the constraining layer in intimate contact with and encasing the viscoelastic damper layer, the constraining layer having a greater stiffness and higher modulus of dynamic shearing elasticity than the viscoelastic damper layer; and

positioning the damper structure in operative association with the housing to dampen noise and/or vibration resonating from the disc drive assembly.

34. A method according to claim 33, wherein the viscoelastic damper layer comprises a polymeric reaction product of a composition comprising a member selected from the group consisting of (meth)acrylic acid and (meth)acrylate.

35. A method according to claim 33, wherein the viscoelastic damper layer comprises a polyacrylate.

36. A method according to claim 33, wherein the viscoelastic damper layer comprises a member selected from the group consisting of nitrile rubbers and fluoroelastomers.

37. A method according to claim 33, wherein the viscoelastic damper layer is free of fillers.

38. A method according to claim 33, wherein the viscoelastic damper layer comprises a plurality of fragments that are noncontinuous with each other to provide interstices between the noncontinuous fragments.

39. A method according to claim 33, wherein the constraining layer further comprises high density filler comprising a member selected from the group consisting of glass, carbon, aramids, metal, plastics, alumina, silica, silicon, ceramic, and graphite.

40. A method according to claim 33, wherein the constraining layer further comprises chopped fiberglass.

41. A method according to claim 33, wherein the modulus of dynamic shearing elasticity of the constraining layer is at least two orders of magnitude greater than that of the viscoelastic damper layer.

42. A method according to claim 33, wherein the modulus of dynamic shearing elasticity of the constraining layer is at least three orders of magnitude greater than that of the viscoelastic damper layer.

43. A method according to claim 33, wherein the modulus of dynamic shearing elasticity of the constraining layer is at least about 500,000 psi.



44. A method according to claim 33, wherein the modulus of dynamic shearing elasticity of the constraining layer is at least about 1,000,000 psi.

45. A method according to claim 33, wherein the constraining layer comprises a member selected from the group consisting of epoxy, polyurethane, polyester, acetal, polystyrene, acrylonitrile-butadiene-styrene, and polyvinylchloride.

46. A method according to claim 33, wherein the constraining layer comprises a polyester.

47. A method according to claim 33, wherein said positioning comprises placing the damper structure in intimate contact with an outer surface of the housing.

48. A method according to claim 33, wherein said positioning comprises placing the damper structure in intimate contact with an inner surface of the housing.

49. A method for damping a disc drive assembly, comprising:  
providing a disc drive assembly comprising a head disc assembly and a housing, the head disc assembly comprising a disc having a surface and a track for storage of information, a head for writing and reading information to and from the disc, and an actuator arm for moving the head relative to the surface of the disc, the housing comprising a base and a cover cooperating

with one another to form a chamber therebetween in which at least a portion of the head disc assembly is housed;

heat molding a curable compound in a mold cavity of a mold and curing the curable compound into a continuous, polymeric constraining layer;

forming a damper structure comprising the continuous, polymeric constraining layer in intimate contact with a viscoelastic damper layer that is substantially immiscible with the curable compound, the constraining layer having a greater stiffness than the viscoelastic damper layer, a modulus of dynamic shearing elasticity of at least 500,000 psi and higher than the viscoelastic damper layer, and a density of at least 3.0 grams per cubic centimeter; and

positioning the damper structure in operative association with the housing to dampen noise and/or vibration resonating from the disc drive assembly.

50. A method according to claim 49, wherein the viscoelastic damper layer comprises a polymeric reaction product of a composition comprising a member selected from the group consisting of (meth)acrylic acid and (meth)acrylate.

51. A method according to claim 49, wherein the viscoelastic damper layer comprises a polyacrylate.

52. A method according to claim 49, wherein the viscoelastic damper comprises a member selected from the group consisting of nitrile rubbers and fluoroelastomers.

53. A method according to claim 49, wherein the viscoelastic damper layer is free of fillers.

54. A method according to claim 49, wherein the viscoelastic damper layer comprises a plurality of fragments that are noncontinuous with each other to provide interstices between the noncontinuous fragments.

55. A method according to claim 49, wherein the constraining layer further comprises high density filler comprising a member selected from the group consisting of glass, carbon, aramids, metal, plastics, alumina, silica, silicon, ceramic, and graphite.

56. A method according to claim 49, wherein the constraining layer further comprises chopped fiberglass.

57. A method according to claim 49, wherein the modulus of dynamic shearing elasticity of the constraining layer is at least two orders of magnitude greater than that of the viscoelastic damper layer.

58. A method according to claim 49, wherein the modulus of dynamic shearing elasticity of the constraining layer is at least three orders of magnitude greater than that of the viscoelastic damper layer.

59. A method according to claim 49, wherein the constraining layer comprises a member selected from the group consisting of epoxy,

polyurethane, polyester, acetal, polystyrene, acrylonitrile-butadiene-styrene, and polyvinylchloride.

60. A method according to claim 49, wherein the constraining layer comprises a polyester.

61. A method according to claim 49, wherein the density of the constraining layer is at least 5.0 grams per cubic centimeter.

62. A method according to claim 49, wherein said positioning comprises placing the damper structure in intimate contact with an outer surface of the housing.

63. A method according to claim 49, wherein said positioning comprises placing the damper structure is in intimate contact with an inner surface of the housing.